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(71)Applicant : HARRIS CORP
(72)Inventor : CAIN JOSEPH BIBB
BILLHARTZ THOMAS JAY
KENNEDY ROBERT ALEX

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(54) MOBILE AD-HOC NETWORK AND METHODS FOR PERFORMING FUNCTIONS THEREIN BASED UPON WEIGHTED QUALITY OF OF SERVICE METRICS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for communicating between a source node and a destination node in a mobile ad-hoc network.
SOLUTION: The method may include transmitting a quality-of-service (QoS) route request from the source node to the destination node via a plurality of intermediate nodes therebetween to discover routing to the destination node based upon a plurality of QoS parameters. Responsive to the QoS route requesta plurality of potential routes between the source node and the destination node may be determined. At such a timea QoS metric corresponding to each of the QoS parameters for each potential route is determined as well. The QoS parameters may be ranked in an order of importanceand each of the QoS metrics weighted based upon the ranking of QoS parameters. As suchthe weighted QoS metrics may be comparedand one of the potential routes may be selected based thereon for the transmission of message data.

CLAIMS

[Claim(s)]
[Claim 1]
It is how to communicate between a source nodesaid source node in a move ad hoc network which has two or more intermediate nodes between destination nodesand said destination node. :
A stage which transmits a QoS route request to said destination node from said source node via said two or more intermediate nodes in order to discover a route to said destination node based on two or more QoS (quality of service) parameters;
A stage of answering said QoS route requestdetermining a possible route of plurality between said source node and said destination nodeand determining QoS metric corresponding to each of said QoS parameter about each of a route with the possibility concerned;
A stage which ranks said QoS parameter in order of importance;
A stage which multiplies said QoS metric each by a weighting factor based on said ranking of said QoS parameter;
A stage which chooses one route from a route which performs QoS metric comparison which multiplied by said weighting factorand has said possibility based on the comparison concerned; it reaches.
A stage which transmits message data to said destination node from said source node via said selected route;
A method ** constituting.
[Claim 2]
QoS metric total which multiplied by said weighting factor about each of a route with said possibilityA method according to claim 1 by which it is performing [including a stage to generate further / QoS metric comparison which multiplied by said weighting factor]-by comparing the QoS metric total concerned which multiplied by said weighting factor characterized.
[Claim 3]
Said QoS metric contains QoS link metric and QoS node metric
Said QoS link metric contains at least one of delay to an end from available bandwidthan error rateand an enddelay change to an end from an enda hop countthe endurance of a course expecteda priority1 directivity / bidirectionand link capacity
A method according to claim 1wherein said QoS node metric contains at least one of battery lifemobilitychannel capacityand positions.
[Claim 4]
Said stage of determining a route with said two or more possibilities :
It is determined whether said node can support said demand QoS parameter of said QoS route requestA stage where the node concerned transmits said QoS route request to a node of one of an intermediate node besides the aboveand said destination nodes when the node concerned can support the QoS parameter

concerned demanded; it reaches.
A stage of taking node resources temporarily about a QoS route request which has a QoS parameter which can be supported in order to define a travel course;
****** -- a method according to claim 1 characterized by things.
[Claim 5]
A stage which carries out a group division at at least one middle cluster containing said intermediate node between a sauce cluster which contains said source node for said nodea destination cluster containing said destination node and said sauce clusterand said destination cluster; it reaches.
A stage where it is the stage of establishing the contiguity cluster target node of said at least one middle clusterand each of a route with said possibility contains the contiguity cluster target node in order to supply an access point;
****** -- a method according to claim 1 characterized by things.
[Claim 6]
Said stage of establishing said contiguity cluster target node :
Two or more target routes between said source node and the possible target node of plurality of said at least one middle cluster are determinedA stage of determining QoS target metric corresponding to each of two or more QoS target parameters about each of the target route concerned;
A stage which ranks said QoS target parameter in order of importance;
A stage which multiplies said QoS target metric each by a weighting factor based on said rank of said target parameter; it reaches.
A stage which performs QoS target metric comparison which multiplied by a weighting factorand chooses said contiguity cluster target node based on the comparison concerned;
****** -- a method according to claim 5 characterized by things.
[Claim 7]
QoS target metric total which multiplied by said weighting factor about each of a route with said possibilityA method according to claim 6wherein said QoS target metric comparison which multiplied by said weighting factor is performed by comparison of said QoS target metric total which multiplied by said weighting factorincluding a stage to generate further.
[Claim 8]
It is the node systematization method for a move ad hoc network which has two or more nodes. :
A stage which carries out the group division of said two or more nodes at a cluster;
A stage corresponding to [are the stage of determining quality-of-service (QoS) node metric about each node in each of said clusterand] a QoS node parameter in QoS node metric concerned;
A stage which ranks said QoS node parameter in order of importance;
A stage which multiplies said QoS node metric each by a weighting factor based on said rank of said QoS node parameter; it reaches.
A stage which receives mutuallycompares QoS node metric which multiplied by

said weighting factor about each of a node of a predetermined clusterand chooses a predetermined cluster leader node of the cluster concerned based on the comparison concerned;
****** -- a node systematization method characterized by things.
[Claim 9]
It is a move ad hoc network. :
A source node;
A destination node; it reaches.
Two or more intermediate nodes between said source node and said destination node;
An implication
Said source node
In order to discover a route to said destination node based on two or more QoS parametersa quality-of-service (QoS) route request is transmitted to said destination node via said two or more intermediate nodes
As a response of said QoS route requestit receives QoS metric corresponding to each of said QoS parameter about each of a route with two or more possibilities to said destination nodeand a route with said possibility
Said QoS parameter is ranked in order of importance
Based on said rank of said QoS parametersaid QoS metric each is multiplied by a weighting factor
QoS metric comparison which multiplied by said weighting factor is performedand a root of 1 is chosen from a route which has said possibility based on the comparison concerned
A move ad hoc network transmitting message data to said destination node via said selected route.
[Claim 10]
Said QoS metric contains QoS link metric and QoS node metric
Said QoS link metric contains at least one of delay from available bandwidthan error rateand an end to an enddelay change from an end to an enda hop countcourse endurance expecteda priority1 directivity / bidirectionand link capacity
The move ad hoc network according to claim 9wherein said QoS node metric contains at least one of battery lifemobilitychannel capacityand positions.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
Especially this invention relates to a move ad hoc wireless network (mobile ad-hoc wireless networks) and the method relevant to this about the technical field of a communication network.

[0002]
[Description of the Prior Art]
Development of a wireless network increased in the past ten years. One of most quickly developed fields is a move ad hoc network. Physicallya move ad hoc network is distributed geographically and contains many movable nodes with a common radio frequency. As compared with the network type [other] like the cellular network (cellular network) or a satellite networkthe feature that a move ad hoc network is also the biggest is that there is no fixed infrastructure. When it is formed only from a moving node and a node communicates with each othera network is in a great hurry and is formed. A network is dynamically adjustedwhen it is not dependent on a specific nodeand some nodes participate in a network or other nodes secede from a network.
[0003]
The fixed communication infrastructure is not reliableOr in bad environment like natural disaster area where the battlefield and earthquake which cannot be usedand hurricane happenedalthough it is possible to arrange an ad hoc network quickly and it is restrictedmuch communication needed is given. While the army is carrying out the still main activities in the back of arrangement of these networksapplication of an ad hoc network is newly quickly found in citizen area or commercial area. They are able for people to be in the outdoors or a classroom and to exchange data by an ad hoc networkwithout using what kind of network only by making one their computer or a personal digital assistant's (PDA) power supply.
[0004]
New application of a move ad hoc network continues appearingand radio will become an important portion of communication structuresince it is spreading round everyday life gradually. A move ad hoc network gives a designer a big difficult problem. Two or more nodes must be organized in personand must be reconstructed as a node movesand it participates in a network or it goes away from a networksince the fixed infrastructure is lacking. Nodes are [no] intrinsically the same and the central controlling part of an ordinary layered structure or a network exists. All the functions must be distributed between nodes. Electric power is often supplied to a node by a batteryand it has the limited communication capability and count ability. This system bandwidth is restricted when the most. Transmission is relayed by other nodesbefore the distance between two nodes exceeding the wireless transmission range and arriving at the destination of transmission. As a resulta network has the topology and the topology of other stage composition and multi-hop (multihop topology)and this topology changes as a node moves about. The move ad hoc network (Mobile Ad-hoc Networks (MANET)) of Internet Engineering Task Force (IETF) evaluated the routing protocol and the multicasting protocol positivelyand has standardized. Since a network topology changes arbitrarily as a node movesInformation becomes - needlessness in ancient times (obsolete)and another node oftenTime (in a certain nodeinformation may become old and may turn into the present

information at other nodes)and space (a node) In both which may only know the network topology in the range as for which a long distance is not not much from themselves contiguity within the limitsit has a viewpoint when networks differ.

[0005]

The routing protocol needs to suit topology change which takes place frequentlyand the information which is not so exact. Routing in these networks differs from routing in other networks dramatically for these original demands. Collecting fresh information about the one whole network requires expenseand it is not often practical. Many routing protocols are reactive protocols (on demand). When requiredthe reactive protocol (reactive protocol) collects routing informationperforms routing to the destination and does not maintain the route which is not used. At all the timesthe routing overhead (routing overhead) is dramatically decreased by this method compared with the proactive protocol (pro-active protocol) which maintains the optimal route to all the destinations. This is important in order for a protocol to have conformity. AODV (Ad Hoc on Demand Distance Vector) and TORA (Temporally Ordered Routing Algorithm)The routing protocol on demand given by the above-mentioned MANET workgroup is represented.

[0006]

DSVD (Destination Sequenced Distance-Vector) routing by which the example of other various routing protocols is indicated by United States patent 5412654th of PerkinsZRP (Zone Routing Protocol) currently indicated by U.S. Pat. No. 6304556 of ** Haas is included. ZRP is a hybrid [be / proactive] protocol using approach reactive [both].

[0007]

In choosing the route from the source node (source node) to a destination nodethe best efforts approach (best effort approach) is used for these conventional routing protocols. Generallythe number of intermediate stage and hop (hops) is the main standards in such best efforts approach. In other wordsthe route with the minimum number of hop and stages is chosen as a transmission route.

[0008]

Quality-of-service (Quality of Survice (QoS)) routing in a move ad hoc network is concerns which are increasing. In order to provide a quality of servicefor a protocol not only to to find a routebut to secure resources (resource) along with a route is needed. In order to manage the resources needed for a quality-of-service route since [for the bandwidth to which the network was restrictedand which is shared] there is no central controlling part controlled in consideration of these limited resourcesthe node must negotiate mutually. This becomes still more complicated by change of topology which takes place frequently. Quality-of-service routing is required rather than the best efforts routing in many cases for these restrictions.

[0009]

Some examples of quality-of-service routing approachThe title by Chenxi Zhu

″Medium. The publication (publication) in 2001 which is Access Control and Quality--of-Service Routing for Mobile Ad Hoc Networks″M. The title by Mirhakkak and others is explained to the publication in 2000 which is ″Dynamic Quality-of-Service for Mobile Ad Hoc Networks″ (MITRE Corp.). Zhu is arguing about establishment of the quality-of-service route to which bandwidth was guaranteed in the small network which has topology change at a medium rate from the small rate. Mirhakkak and others has turned concern to the resource savings request which specifies the range of the value of QoS (quality of service)and it is promised that a network provides service within the limits of this.

[0010]

In each nodein order that recognition control may transmit the traffic (traffic) from other nodesit performs. Generallythe conventional recognition control protocol is a protocol for sufficient indication about a route and connection. In other wordseach node shares connection data with all the route and other nodes with other nodes. On the wholeit sees and the best efforts route is chosen by this.

[0011]

[Patent documents 1]

United States patent 5412654th

[Patent documents 2]

U.S. Pat. No. 6304556

[Patent documents 3]

U.S. patent application 10th / No. 134715

[Patent documents 4]

U.S. patent application 10th / No. 134559

[Nonpatent literature 1]

The publication in 2001 whose title by Chenxi Zhu is ″Medium Access Control and Quality-of-Service Routing for Mobile Ad Hoc Networks″ (publication)

[Nonpatent literature 2]

M. The publication in 2000 whose title by Mirhakkak and others is ″Dynamic Quality-of-Service for Mobile Ad Hoc Networks″ (MITRE Corp.)

[Nonpatent literature 3]

Routing in Ad-Hoc Networks using Minimum Connected Dominating Sets(IEEE Int. Conf (ICC) about communication) in 1997 which Das and others indicated
'97

[Nonpatent literature 4]

Routing in Ad-Hoc Networksusing a Spine(IEEE Int. Conf. about the online communications and the network in 1997 (IC3N'97)) which Das and others indicated

[Nonpatent literature 5]

The Clade Vertebrata by Sivakumar and others : Spines and Routing in Ad-Hoc Networks(IEEE symposium about the computer in 1988and communication)

[Problem(s) to be Solved by the Invention]

Since many nodes are includedthe difficult problem of development of an ad hoc network is extending such a network. One trial of the advanced technology for

doing so is using spine network routing (spine routing). The example of this spine routingRouting in Ad-Hoc Networks usingMinimum Connected Dominating Sets(explained to IEEE Int. Conf (ICC'97) about communication.) in 1997 which Das and others indicated In this approacha spine or virtual backbone is defined as there being many each network nodes from a spine nodeand being in the position and distance of one hop and a stage. Global topology (link condition) is maintained by each spine node. A link condition routing algorithm is performed by each spine nodein order to generate the present route to all the destinations.

[0012]

Another related approach is CSR (clustered spine routing). This CSR is explained to "Routing in Ad-Hoc Networks using a Spine" (IEEE Int. Conf. about the online communications and the network in 1997 (IC3N'97)) which Das and others indicated. By carrying out the group division of the node at a clusterand adding the second class level to OSR approachit has intention of this approach so that spine routing can be applied to a big network. Another approach is known as PSR (prtial knowledge spine routing). "The Clade Vertebrata according [this PSR] to Sivakumar and others : It is indicated by Spines and Routing in Ad-Hoc Networks" (IEEE symposium about the computer in 1988and communication).

[0013]

Each one common characteristic of the cluster / spine approach of the above-mentioned advanced technology is that each of these approaches depends on proactive routing. One potential fault of proactive routing is that proactive routing needs the routing overhead of quantity most in order to maintain the optimal route to all the destinations at all the times. This problem is especially easily conspicuouswhen applied to the ad hoc network containing very many nodes. Other problem and difficult problems you made [difficult problems] to be faced when a cluster / spine approach is carried out are how to specify a cluster leader node about each cluster by relating a node to a cluster efficiently.

[0014]

It is that the purpose of this invention provides systematization of the efficient cluster within a networka move ad hoc networkand a related method with a route being efficient for establishing from a viewpoint of an above-mentioned background art.

[0015]

[Means for Solving the Problem]

In a move ad hoc network containing two or more intermediate nodes which exist between a source node and a destination nodethis purpose according to this invention and other purposes can be attained by a method of this invention for communication between a source node and a destination node. This method includes a stage which passes through a quality-of-service (QoS) route request from a source node via two or more intermediate nodesand transmits to a destination nodein order to discover a route to a destination node based on two or more QoS parameters. This QoS route request is answered and a route with two or more possibilities between a source node and a destination node may be

determined with QoS metric corresponding to each of a QoS parameter about each of a route with such possibilities. a QoS parameter is ranked in order of importanceand may be carried outand a weighting factor may multiply QoS metric each by it based on a rank of a QoS parameter. QoS metric which multiplied by a weighting factor such is compared as it is mutualand based on this comparisona root of 1 may be chosen from possible routes. Message data is transmitted to a destination node from a source node via a selected route.

[0016]

By a method which was mentioned abovea route request may be used in order to perform route discovery about a QoS course for a reactive routing protocol with link metric and node metric. In order to discover a best route and resources for savings out of a proactive route known nowsame approach may be used using a proactive routing protocol.

[0017]

Thereforethis invention has the flexibility which chooses a route for communication between a source node and a destination node based on many QoS parametersand provides an efficient method. Thusit is possible to raise performance in much application and operating environment byfor examplemultiplying by a big weighting factor with a QoS parameter which has the biggest importance in predetermined application.

[0018]

Especially a method of this invention compares these totalin order to generate further QoS metric total which multiplied by a weighting factor about each of a possible route and to choose a suitable route. QoS metric may contain QoS link metric or/and QoS node metric. For exampleQoS link metric may contain at least one of delay from available bandwidthan error rateand an end to an enddelay change from an end to an enda hop countcourse endurance expecteda priority1 directivity / bidirectionand link capacity. QoS node metric may contain at least one of battery lifemobilitychannel capacityand positions.

[0019]

Said stage of determining two or more possible routes. A stage of determining whether the node concerned can support a demand QoS parameter of a QoS route request by each intermediate node may be included. When a QoS parameter with which an intermediate node is demanded can be supportedthe intermediate node concerned transmits a QoS route request to one node in other intermediate nodes and a destination node. Thusin order to define and determine a travel course (define)node resources may be temporarily taken about a QoS route request containing a QoS parameter which can be supported. Furtherwhen a QoS route request is received in a destination nodesaid stage of determining two or more possible routes such may generate a reply to a source nodeand may include a stage which transmits this reply via said travel course.

[0020]

This method may include a stage which transmits a route check to an intermediate node by a selected routebefore transmitting message data. It may be detected

whether in each and a destination node of an intermediate nodethe node concerned can continue and support a demand QoS parameter of a QoS route requestWhen can continue a QoS parameter with which the node concerned is demandedit could not be supported and it is detectedin the node concerneda QoS error notification is generated and it is transmitted to a source node. In such a casein order to supply backupat least one substitution route may be chosen in a source nodefor example.

[0021]

A method of this invention may include a stage which carries out a group division in a sauce cluster which contains a source node for a nodea destination cluster containing a destination nodeand a sauce cluster and a middle cluster containing an intermediate node between destination clusters. In order that the contiguity cluster target node may supply an access pointit may be established in at least one middle cluster. Each of a possible route may contain the contiguity cluster target node.

[0022]

A target route between a source node and the target node with two or more possibilities that it can set to at least one middle cluster is determinedThe contiguity cluster target node may be established by determining QoS target metric corresponding to each of two or more QoS target parameters about each target routeand ranking a QoS target parameter in order of importance. Based on a rank of a QoS target parameterQoS target metric each may be multiplied by a weighting factor. QoS target metric by which a weighting factor multiplied may be comparedand the contiguity cluster target node may be chosen based on this comparison. By this approachwhen choosing the contiguity cluster target nodebigger flexibility is obtainedand bigger efficiency is obtained by multiplying by a weighting factor based on a more important QoS parameter in a predetermined situation.

[0023]

Especially a method of this invention may compare mutually these QoS target metric total that multiplied by a weighting factorin order to generate QoS target metric total which multiplied by a weighting factor about each of a possible route and to choose the contiguity cluster target node. QoS target metric may contain at least one of course endurance which it is delay-changed [delay from available bandwidthan error rateand an end to an endand] from an end to an endand is expecteda priority1 directivity / bidirectionand link capacity.

[0024]

An another related method of this invention is a method for systematizing a node in a move ad hoc network containing two or more nodes. This method may include a stage which carries out the group division of two or more nodes at a clusterand a stage of determining quality-of-service (QoS) node metric about each node in each cluster. Hereeach QoS node metric may correspond to a QoS node parameter. A QoS node parameter may be ranked in order of importanceand a weighting factor may multiply QoS node metric each by it based on a rank of a

QoS node parameter. QoS node metric by which a weighting factor about each node in a predetermined cluster multiplied is compared mutuallyand a predetermined cluster leader node is chosen about a predetermined cluster based on this comparison. An efficient process with flexibility which chooses a cluster leader node by a mode of this method in a move ad hoc network by which a group division is carried out to a cluster using many QoS parameters is provided.
[0025]
Similarlya method of this invention may include a stage which supplies an additional node to a move ad hoc networka stage of establishing a route from an additional node to at least one node in each of a clusterand a stage of determining QoS link metric about each route. Each QoS link metric corresponds to a QoS link parameter preferably. a QoS link parameter is ranked in order of importanceand may be carried outa weighting factor may take the advantage of QoS link metric each based on a rank of a QoS link parameterand QoS link metric by which a weighting factor multiplied may be compared. Based on this comparisonan additional node may join together and unite at a cluster of one of two or more clusters (connected).
[0026]
QoS link metric may contain at least one of delay from available bandwidthan error rateand an end to an enddelay change from an end to an enda hop countcourse endurance expecteda priority1 directivity / bidirectionand link capacity. This method may have a stage which generates further total about each QoS link metric route by which a weighting factor multiplied. In said QoS link metric comparison by which a weighting factor multipliedthese QoS link metric total by which a weighting factor multiplied receives mutuallyand may be compared.
[0027]
This method may include a stage which generates total about each QoS node metric node by which a weighting factor multiplied. These QoS node metric total by which a weighting factor about each node of a predetermined cluster multiplied receives mutuallyand may be compared. For exampleQoS node metric may contain at least one of battery lifemobilityand channel capacity **** positions.
[0028]
[Embodiment of the Invention]
Belowwith reference to an attached drawingthe suitable embodiment of this invention is described in more detail. Howeveroperation must not become possible in the form of manyand this invention must not be interpreted as what is limited to the embodiment described below. By giving the embodiment described belowprobably the indication of this application becomes perfectand the person skilled in the art could fully understand and recognize the range of this invention. A same and similar reference mark corresponds to a same and similar element over the whole.
[0029]
One copy of this invention may be embodied as a methoda data processing systemor a computer program product so that I may be understood by the person

skilled in the art. Thereforeon the wholethese portions of this invention may take the embodiment or the form which is an embodiment of software on the whole of Hardware. One copy of this invention may be a computer program product on [which can be computer read] a storage. On this storagethis storage that can be computer read may have a program code which can be computer read. What kind of suitable storage containing a static storagedynamic storagea hard diskan optical storage deviceand a magnetic storage device and which can be computer read may be used for the embodiment of this invention.

[0030]

Belowthis invention is explained with reference to the flow chart figure of a methoda systemand a computer program product according to the embodiment of this inventionetc. It will be understood that combination of the block of a figure or a block of a figure can be carried out by a computer program instruction. So that the instruction performed via the processor of a computer or other programmable data processing devices may function 1 or the illustrated block beyond itThese computer program instructions are supplied to the computer for generala computer for exclusive useor the processor of a programmable data processing device.

[0031]

These computer program instructions ordered to function on a computer or other programmable data processing devices by a specific method may be memorized by the memory which can be computer read. The instruction memorized by this by this memory that can be computer read can serve as a product containing the instruction which carries out the function specified by one or more flow chart blocks. A computer program instruction may be loaded to a computer or other programmable data processing devices. By thisa series of processing stages can be performed on a computer or other programmable data processing devices. The instruction performed in a computer or other programmable data processing devices as a result will give the stage of carrying out the function specified by one or more flow chart blocks.

[0032]

If 5 is first referred to from drawing 1the method of determining the route from a source node to a destination node in the move ad hoc network 20 will be explained. The network 20 has two or more movable nodes 30. These movable nodes 30 have the source node 1 and the destination node 4and have further the intermediate nodes 23and 5 which exist between the source node 1 and the destination node 4. A laptop computera personal digital assistant (PDA)or the node 30 like a cellular phone is connected by the wireless communications link 32 so that I may be understood by the person skilled in the art. A method is started in the block 100and as shown in the block 102 of drawing 5in order to determine the route to the destination node 4 based on a QoS parameterthe quality-of-service (QoS) route request RREQQ is transmitted from the source node 1. So that it may be explained in detail below a QoS parameterIt is based on change of the delay (end-to-end delay) from desirable available bandwidthan error rateand an end to an

endand delay from an end to an endthe hop count (hop count)the endurance of the course expectedand/or a priority. BelowQoS metric (metrics (metric)) of other is explained. The route request RREQQ contains a QoS flow identifier and QoS link metric which can be updated.

[0033]

In the block 104the node containing the intermediate nodes 23and 5 determines whether the QoS parameter which the QoS route request RREQQ requires can be supported and supported (support). When a node cannot support the QoS parameter of the specific request RREQQin the block 106a request is denied and a request is not transmitted by this node. When a node (for examplenode 3) can support the QoS parameter of this specific request RREQQ- this node updates QoS link metrictransmits this QoS route request to other intermediate nodes 2 and 5and takes node resources temporarily for this QoS route request -- store (block 108). The intermediate nodes 2 and 5 must also determine whether these nodes 2 and 5 can support the QoS route request RREQQ transmitted from the node 3. When it can supportthe route request RREQQ with updated QoS link metric is transmitted to the destination node 4.

[0034]

The destination node 4 will generate the reply RREPQ to the source node 1if the QoS route request RREQQ is received (block 110). According to this embodimentthe reply RREPQ has a flow identifier (flow identifier) and QoS link metric which were updated. Updated QoS link metric of this is related with the each discovered route. In other wordsthe destination node 4 may receive the QoS route request RREQQ transmitted even from where of various possible routes containing 1-2-4 or 1-3-5-4for example. In each casethe reply RREPQ is generated. In the block 112the source node 1 generates QoS route metric (plurality) based on updated QoS link metric (plurality) which is contained in the reply RREPQ from the destination node 1 about the discovered route. In the block 114the source node 1 chooses the route to the destination node 4 based on generated QoS route metric.

[0035]

In particularin some embodiments of this inventionthe route to the destination node 4 may be chosen using two or more QoS route metric weighted averages. Such an embodiment is described with reference to drawing 6. The method shown in drawing 6 is supplied for communication between the source node 1 in the move ad hoc network 20and the destination node 4. A method is started in the block 60 and a QoS route request is transmitted to the destination node 4 from the source node 1 via two or more intermediate nodes 23and 5. By thisas mentioned abovethe route to a destination node is found out based on two or more QoS parameters (discover). A QoS route request is answeredand in the block 62the possible route of the plurality between the source node 1 and the destination node 4 is determined with QoS route metric corresponding to each QoS parameter about each possible routeas mentioned above.

[0036]

Metric collection may be performed by various methods. For examplethis may be performed by collecting overall metric vectors in the source node 1 using DSR type an algorithm or a link condition algorithm (link statealgorithm) so that I may be understood by the person skilled in the art. By adding the contribution in an intermediate nodemetric collection calculates a course vector augumentative and may be performed. The latter approach will give many restrictions according to the course of the whole which may be supportedand a network metric form. Of coursea person skilled in the art may be carried out using many move ad hoc routing protocols containing the reactive protocol and proactive protocol of the advanced technology which this invention mentioned above. Although a reactive protocol is explainedsimultaneous transmissive communication (broadcast) may be restricted to the existing proactive route knownand a proactive protocol may be used.

[0037]

According to the mode of the reactive protocol of this inventionin the block 63a QoS parameter may be ranked in order of importance. Preferablybased on the determination of a network function purpose (network performance objectives)it is carried out before network arrangement and dispositionand this rank is **** so that I may be understood by the person skilled in the art. A weighting factor is determined by the rank. The weighting factor is beforehand determined about each nodeor is set up by network management. The node does not need to know the rank during the actual operation of a node. Ratherthe node needs to know the weighting factor. The rank about various move ad hoc network functions is shown in the next table 1.

[0038]

[Table 1]

As shown in Table 1when choosing a routevarious ranks may be used based on the type of the route desired. For examplethe "QoS bandwidth course" which is one item of a column gives the rank of five QoS parameters most important for obtaining a route with the greatest bandwidth. Similarlythe "Qos delay course" which is one item of a columnand the "best efforts course" give the rank for choosing the highest route of probability that can transmit message data using a route or the best efforts approach with the respectively smallest delaying amount. Of courseit may be used for application with various specific ranksand it will be understood by the person skilled in the art that other route discovery function and characteristics may be ranked according to this invention. The stage of performing the rank shown in the block 63 does not need to be performed in the illustrated turn (for examplethe rank may be performed beforehand).

[0039]

Based on the rank of the QoS parameter used for predetermined applicationthe weighting factor may multiply by QoS metric each by the source node 1 in the

block 64. Assigning a suitable value preferably to weight-vector w may be performed before operation (operation) based on a metric rankas mentioned above. As actually multiplying metric one by a weighting factor was shown in the expression which is explained below and given preferablyit performs between operations of real time. SuchQoS route metric which was able to apply the weighting factor is compared as it is mutualand in the block 65one of possible routes is chosen based on this comparison. Once a route is chosenin the block 66message data will be transmitted to the destination node 4 from the source node 1 via the selected route. Thusexecution of a method may be completed (block 67). It has intention of this message data so that additional request/replya video datavoice datadata (not limited to these) of a character and a numberetc. which are transmitted between the nodes of a move ad hoc network between operations may be included.

[0040]

According to the specific embodiment- convenience of QoS metric is beneficially goodand it contains QoS link metric and/or QoS node metric. Especially QoS link metric may contain at least one of delay from available bandwidthan error rateand an end to an endthe delay change from an end to an enda hop countthe endurance of the course expecteda priority1 directivity / bidirectionand link capacity. QoS node metric may contain at least one of battery lifemobility and mobilitychannel capacityand positions. The further QoS node metric / QoS link metric example is given to Table 1. Of courseQoS node metric / QoS link metric of other known by the person skilled in the art may be used.

[0041]

Multiplying by a weighting factor is explained to QoS node metric / QoS link metric mentioned above about two specific examples. Generallywhen choosing a routetwo or more QoS metric total which multiplied by the weighting factor is preferably generated about each of a possible routefor example. The QoS metric total which multiplied by each weighting factor of the possible route is compared with each total which multiplied by other remaining QoS node metric / QoS link metric weighting factorsand a final route is chosen based on this comparison. Before explaining a specific examplethe following term and the definition are described in order to help an understanding of these specific examples.

[0042]

Link metric vector m_L and node metric vector m_N are defined about the following examples. When evaluating a routeeach of link metric vector m_L and node metric vector m_N is the important characteristic in order to satisfy various QoS demands in network organization. A node metric form is given by $m_N= (C_{N1}C_{N2}C_{N3}...)$. Here$C_{Ni}$ is the i-th ingredient of a node metric vector. A link metric form is given by $m_L= (C_{L1}C_{L2}C_{L3}...)$. Here$C_{Li}$ is the i-th ingredient of a link metric vector. A link metric vector and a node metric vector can be transmitted over the network 20 by a network control packet so that I may be understood by the person skilled in the art.

[0043]

Unsettled course metric about the route from the source node 11 to the destination node k+1It is expressed by a node / link metric vector m_P= ($m_{L1}m_N \cdot m_{L2} \ldots m_{L(k-1)} m_{Nk} m_{Lk}$). As mentioned abovean important metric ingredient is ranked in predetermined application. Link weight-vector W_L and node weight-vector W_N may be defined. In order to give desirable emphasis in predetermined application so that I may be understood by the person skilled in the artthese metric vectors may contain the ingredient which are not zero and zero. The last target may be a scalar evaluated and expressed as a function of a course metric vector with unsettled course metrica node weight vectorand a link weight vector. Scalar final train metric of this is given by M_P=F ($W_N W_L m_P$). A course or a route is preferably chosen based on the best value of final train metric M_P. Of courseit may depend on specific application (for examplea QoS delay courseQoS capacity assignmentthe best effortsetc.) for the form of function F() used.

[0044]

The 1st QoS course metric example sensitive to delay is explained. The 1st course metric formula given belowA hop count (dignity of 1 (weight))bidirection (in a bidirectional link) in the link of BD=0 and 1 directionit has dignity K_3 by BD=1 -- the estimated link delay (it has dignity K_1) and the ingredient about the reciprocal (it has dignity K_2) of link capacity are used. In this examplethe best course corresponds to minimum course metric. The parameter about such dignity is preferably specified beforehand by creating beforehand based on a performance characteristic of operation. Such 1st course metric is expressed with the following formula.

[0045]

[Equation 1]

The second example that determines a route using QoS route metric is a thing of a sake when capacity quota C_{req} to which QoS (quality of service) for flow quota necessity is guaranteed is required. The formula of the following course metric example [2nd] Available link capacity C_A (it has the dignity of 1)The ingredient about the estimated transmission frequency (it has dignity K_3) and bidirection (it has dignity K_4) by a packet in the estimated delay reference gap (it has dignity K_2) and link which were link-delayed (it has the dignity K1)and were estimated is included. In this casethe best course has minimum course metric. Such 2nd course metric is given by the following formula.

[0046]

[Equation 2]

Other modes of an above-mentioned method are explained with reference to 9 from drawing 7. The illustration move ad hoc network 210 indicated to be drawing

8 to 9 contains two or more nodes 211 connected by the wireless communications link 213. In radio ad hoc networkssuch as a computer and a personal digital assistant (PDA)what suitable type of the radio communication equipment which can communicate of thing may be sufficient as the node 211 so that I may be understood by the person skilled in the art. Of coursewhen wishedin some embodimentssome of nodes 211 are connected to the fixed communication infrastructure so that operation is possible.

[0047]

The group division of the node 211 is preferably carried out like the circle surrounding each group of drawing 8 and the node in 9 at the cluster 212. Carrying out the group division of the node 211 at the cluster 212 is explained in detail below. One of the nodes 211 is specified as each cluster leader node 221-233 about each of the cluster 212. The function of the process of specifying the cluster leader nodes 221-233and this process is explained below. In order to explain clearlywhen explaining the cluster 212 about eachthe same reference mark as the cluster leader node of the cluster concerned is given to a certain specific cluster. For examplethe cluster leader node 221 exists in the cluster 221.

[0048]

According to the mode of this method of this inventiona method is started in the block 70and as mentioned abovein the block 71the group division of the node is carried out at a cluster. Thenso that the target node (for examplenode 217a) of an adjoining cluster may be explained in detail belowIn order to provide an access point and to make routing possible through a clusterit is established in at least one middle cluster (for examplecluster 225). This is beneficially performed with sufficient - convenience by determining a target route between the source node 214 and two or more possible target nodes of the middle cluster 225 so that it may be explained in detail below. As explained in a topselection from the target node with various possibilities in the cluster 225 is due to QoS metric which was able to apply a weighting factor again. That isit is determined that QoS target metric will correspond to each of two or more QoS target parameters desired about each target route preferably (block 72).

[0049]

A QoS target parameter may be ranked in order of importance in the block 73as mentioned above. In "ACTN node selection" used as an item of a columnespecially the table 1 includes illustration langue attachment about contiguity cluster target node specification. Of courseother QoS parameters and other ranking ranking may be used in various application so that I may be understood by person skilled in the art.

[0050]

After thatQoS target metric is multiplied by a weighting factor based on QoS target metric rankingas mentioned above (block 74). QoS target metric multiplied by a weighting factor is compared as it is mutual. The contiguity cluster target node (this example node 217a) is chosen by this based on comparison of a block 75 smell lever. HereQoS target metric total which was able to apply a weighting

factor is generated about each of a route which is possible using the 1st above-mentioned formula and the 2nd formulaand same suitable formula. A best route between the source node 214 and the destination node 215 is chosen so that it may pass along the middle cluster 225 containing the contiguity cluster target node 217a (block 76).

[0051]

Of coursea person skilled in the art will recognize that many middle clusters may exist between the sauce cluster 221 and the destination cluster 232for exampleas indicated in 9 as drawing 8. In order to explain clearlyselection of only the contiguity cluster leader node 217a was explainedbut it will be understood that the same approach may be used in order to determine 217 d from the continuing contiguity cluster target node 217b along with the final route shown in drawing 9. Thusmessage data is transmitted to the destination node 215 from the source node 214 via the middle cluster 225 (in an illustrated examplethe middle clusters 224229226and 232 also exist). Target metric used for this approach may contain link node metric and/or node metricfor exampleas mentioned above.

[0052]

If drawing 5 is referred to againin the block 116the source node 1 will transmit to an intermediate node by a route which had the route check CONFQ chosen. This is for checking use of resources in a selected route temporarily taken in the block 108. Resources temporarily taken besides a route which is not chosen although discovered may be changed into a state usable to timeout without transmitting CONFQ by those routes.

[0053]

The source node 1 may choose at least one substitution route without transmitting the check CONFQ to an intermediate node on a substitution route or transmitting. Such a standby route and a substitution route (standby route)It may be for duplicate transmission (duplicate transmission) and additional reliabilityor may use as a backup route of a sake in the case of route failure and/or a QoS deficit. In the block 118the intermediate nodes 23and 5 and/or the destination node 4 may detect whether a QoS parameter which a node continues and the QoS route request RREQQ requires always can be supported. When a node can continue and support the request RREQQ through transfer of traffic (traffic)Taken resources and a related route are inactive in the block 126 (when being in a state (inactive) which is not used is determined). It is [in / when it changes into an usable state and is not used during a certain time to timeout for data trafficor when not being used during a certain time for transmission of a periodic CONFQ message / the block 128] release ****.

[0054]

When a node cannot support the request RREQQ continuouslya node transmits QoS error notification RERRQ to the source node 1 (block 120). in this casethe source node 1 transmits the quality-of-service (QoS) route request RREQin order to discover the new route to the destination node 4 based on a QoS parameter -- on the other hand (block 102)A selected route may be maintained when QoS error

notification RERRQ is received. The source node 1 may be changed to a substitution routewhen QoS error notification RERRQ is received (block 124).

[0055]

A mode of a method of this invention mentioned above so that I may be understood by person skilled in the artIt may apply to a type thing like a routing protocol on demand like dynamic source routing (DSR) or AODV routing mentioned aboveor a reactive protocol throatOr it may apply to what kind of hybrid proactive protocol like the zone routing protocol ZRPor a hybrid reactive protocol.

[0056]

In consideration of assignment and maximum delay restrictions of minimum bandwidthan example**sis explained as a category of QoS. The node 30 assumes that capacity or bandwidth of a certain quantity can be taken about assignment of predetermined bandwidth. The node 1 of traffic flow transmits about each of flow (flow) of which the QoS route request RREQQ is required (Q of the last of RREQQ shows a QoS request). A RREQQ message performs a function to discover a route which can support QoS demanded. It declares whether the node which transmits RREQQ to the destination 4 can satisfy QoS demanded before transmitting RREQQ (note)and these nodes take resources temporarilywhen required. It sends a reply from a destination with notice whether QoS as which a route answer RREPQ packet is required covering the course is satisfied. In order for the source node 1 to supply QoS desiredbefore opting for the best selectionit may collect courses with two or more possibilities to the destination 4. Once this course is determineda check CONFQ message will be transmitted to the destination 4 in accordance with a shown course. Any resources temporarily taken on this course are checked as it is eternal and long-term savings. When savings (reservation) of QoS are not used during predetermined timesavings of QoS pass the deadline. When a link in alignment with a route is out of order (fail)or when a QoS request is not satisfieda route error (RREQQ) packet is generated and is returned to a source node.

[0057]

When the new QoS route to the destination node 4 given especially is neededthe source node 1 carries out the simultaneous transmissive communication of the RREQQ packet to a destination node (broadcast). This is a thing of the conventional RREQ packet used in DSR or a protocol like AODVand same packet specific type. The conventional RREQ simultaneous transmissive communication is used for the best efforts service. A method of this invention may follow the conventional procedure established by a protocol for the best efforts service.

[0058]

When specified minimum capacity or bandwidth is required for traffic flowa special RREQQ packet is used in order to take a flow to the destination node 4 by specified capacity. In this caseflow ID is assigned to RREQQ by the source node 1. This flow ID is uniquely identified by a flow to every node which it is combined with a source node address and transmits a flow in the network 20. A RREQQ packet also shows capacity (capacity) which should be taken.

[0059]
A minimum capacity demand or the minimum global-area width demand is checked to available capacity by each nodes 23and 5 in a course to the destination 4and it is determined whether savings are possible because of a flow. When traffic carrying capacity as which a node is required can be accommodated and receivedcapacity is temporarily taken for the flow ID (stored). When a CONFQ message is not received between short timethese temporary savings are released. When it has intention so that it may guarantee that a course for which RREQQ does not exceed specified maximum delay is foundEach node in alignment with a course performs evaluation and an estimate of contribution of the node concerned to total path delayand in order to confirm whether it is over restriction of maximum delay that delay of the sum total which added an old contribution in alignment with a course was specifiedit must be able to check and inspect it.
[0060]
In order to determine whether an effective course with which it is satisfied of a QoS demand exists unlike DSR for the best efforts trafficor application of the former of AODVRREQQ can be spread [transfer and] through a course to the destination node 4. When such a course is foundthe destination node 4 generates a RREPQ message which should be replied to the source node 1. An effective course to the destination node 4 which satisfies QoS demanded is found in this messageand it is shown to a source node that a course was established (in the case of DSRreturned at a source route and a transmitting agency course). Estimated path delay is contained in RREPQ for a course which guarantees a request which asks for a delay guaranteeand capacity.
[0061]
The source node 1 may receive the composite RREPQ about two or more courses to the destination node 4 which satisfies QoS demanded (multiple RREPQ). The source node 1 sends a CONFQ message which shows selection of a course which is a course which ranks ranking of these courses and is ranked most highly. Although other courses may be maintained as a backup coursewhen CONFQ is not transmitted on these courses and it is needed as a course instead of backupit is not guaranteed that resources demanded are available.
[0062]
Since it knows not satisfying QoS as which a course which passes along this node is required when QoS demanded in the destination node 4 in one of the intermediate nodes 23and 5 is not satisfieda RREQQ packet is canceled. Howeverother courses may be found by a discovery process. When a link breaks down at one of the timesor when a QoS demand is not satisfieda route error RERRQ packet is generated and it replies to the source node 1 about each of traffic flow influenced by failure. In this casea backup course must be used or a route discovery process is started again.
[0063]
A procedure mentioned above is simply applied to a DSR protocol. Conventionally RREQ of a DSR message typeRREPand RRERIt is possible to be usedas it defines

as a packet type of alternative - option and was defined as supporting the best efforts traffic in opposite direction conformity Mohd (backwards compatibility mode) for operation of the former of a protocol. The new packet type containing RREQQRREPQRRERQand a CONFQ packet type which are used for managing a QoS course is defined in order to support QoS. A definition of a header field as which these types are required is based on a function which Kami defined directly. A special type of a QoS source routing packet (QoS source routedpacket) for QoS missions data is also included. This packet for QoS missions data may contain flow IDin order to identify to which flow a packet belongsand in order to take measurement (metering) of flow traffic into consideration. The following procedures may be used when a node generates a RERRQ packet by failure. When a RERRQ packet is received in a source nodethe present route is canceled and a backup route is tried. The first packet transmitted on a backup route may be a special QoS source routing packet (for exampleRREQT containing flow ID and a QoS parameter) another type. Missions data can also be included by this packet. Each node in alignment with a course must carry out an inspection and a checkin order that the node concerned may check whether savings temporary for a flow are still maintained. When these nodes are not maintaining temporary savingsthese nodes check againin order to check whether the node concerned can support a flow and whether temporary savings can be carried out. While a flow is supported by each intermediate nodewhen a packet arrives at a destinationa destination node replies a RREPQ packet for reporting that a course is effective in a source node.

[0064]

When one of nodes cannot support a flowa packet is canceled and this node replies a RERRQ packet for notifying a source node that a QoS parameter with which a course is demanded cannot be supported to a source node. If a source node receives a RREPQ packeta source node will transmit in accordance with a course which had a CONFQ message which checks selection of a course for a CONFQ message chosen in addition to transmitting missions data about traffic flow continuously.

[0065]

When the source node 1 receives a RERRQ packetthe source node 1 tries the same procedure in the following available backup course (it performs). A source node starts one route discovery process for the new QoS course to a destination node in which haveand a source node is another when **** for a backup node to a destination. Data flow is interrupted until a new route is found. It is possible to define a data structure required of managing resources assigned to each traffic flow about every specific protocoland it is possible to also define a method and a method of identifying a flowand a method and a method of investigating a route assigned to each flow. Further details of routing based on a QoS parameter are explained to above-mentioned U.S. patent application 10th / No. 134715.

[0066]

Details of operation of selection of cluster union and a cluster leader node

mentioned above are explained with reference to drawing 10. An outline of selection of a new cluster leader is illustrated in drawing 10. The clusters 301 and 302 have the specified cluster leader nodes 301 and 302respectively. If it explains using an example shown in drawing 10details of operation of node start-up selection and cluster union will be explained.

[0067]

If start up takes place about node start up and cluster unionthe node 303 will perform the following stage. The node 303 hears a periodic cluster leader node announcement (CLNANN) message from a cluster leader node of an adjoining cluster (at this examplethey are the clusters 301 and 302) (listen for)The node 303 identifies a cluster which may be participated and connected (join). The node 303 may hear a periodic HELLO message from the node 211 of a hop area of eye k_N watchin order to collect course metric information to all the nodes of a hop area (hop neighborhood) of eye k_N watch. The node 303 carries out the simultaneous transmissive communication of the periodic HELLO message to all the nodes of a hop area of eye k_N watch. Thencluster union metric M_m^{CA} (cluster assciation metric)It may be formed about each contiguity cluster leader mand the cluster leader node m may be chosen as a cluster which participates using the minimum cluster union metric M_m^{CA}.

[0068]

Cluster union metric M_m^{CA} is smaller than threshold T_J preferablyin order to show that it is close to a cluster in which a considered node tends to participate enough. When this threshold is satisfiedthe cluster participating message CLJOIN is transmitted to the cluster leader node m. When a cluster has a node number of a value smaller than restriction L_{CL} about the number of nodes for every clustera cluster leader node accepts a node in a clusterand transmits the admission message CLACCEPT to the node concerned. When a cluster leader node cannot accept another membera cluster leader node transmits the refusal message CLREJECT to the node concerned. When a node is refusedthe node concerned chooses the following best cluster leader node as backupand in order to participate in the clusterit repeats a process. the node 303 according to an above-mentioned process cooks -- **** -- for exampleit becomes a member of the cluster 212 ordinarily immediately after start up and a power turn (powering up). Another approach which unites and relates the node 303 at a cluster is explained with reference to drawing 11. If explanation is continued in an example shown in drawing 10 in this another approachit will be started with the block 90and a mode of this method will carry out the group division of the node 211 at the cluster 212as mentioned above. When it is given to a network with the block 82 for union with the cluster 212 of the additional node 303 (for examplewhen the node 303 starts) with the block 83. A route from a node to at least one additional node in each cluster (at this examplethey are the clusters 301 and 302) is established. Establishment of this route may be performed using art mentioned above. In some embodimentsa node by which a route in the cluster 212 was established is a cluster leader node of the cluster. In other embodimentsthis node may be a node

nearest to the additional node 303 in the cluster 212 from a viewpoint of a hop count. A node (or two or more nodes) besides being understood by person skilled in the art (for route establishment) may be used in other embodiments.
[0069]
According to one embodiment of this inventiona method of this invention may include a stage of determining QoS link metric about each routein the block 84. This stage may be performed as explained with reference to drawing 6. Each QoS link metric supports a QoS link parameter which was mentioned above. A QoS link parameter is ranked in the block 85 in order of importanceas mentioned above. Approach of such one illustration rank is given to an item "cluster intervention" of a column of Table 1. Other QoS parameters and ranks may be used by various embodiments. As mentioned abovebased on a rank of a QoS link parameter to QoS link metric. A weighting factor takes an advantage (block 86)and in order to determine which cluster to be the best for participating [it is related and] and uniting for the node 303in the block 87QoS link metric by which a weighting factor multiplied receives mutuallyand is compared. Thusa method is completed (block 88). QoS link metric total which multiplied by a weighting factor may be generated about each route. In order to determine the cluster 212 best for participating and being relatedQoS link metric which multiplied by a weighting factor receives mutuallyand may be compared.
A formula which may be used for node intervention and connection is given below. For exampleas the node 303 opted for and mentioned above which clusters 301 and 302 participatethis node collects course metric (path_met) information on a node of an adjoining cluster (at this examplethey are the clusters 301 and 302)and forms area metric. The following formula includes the number of times (it has dignity K_1) and bidirection (it has dignity K_2) which transmission by QoS parameter reciprocal link capacity (it has the dignity 1) and a packet in a link estimated. In this examplea bigger weighting factor than other nodes takes the advantage of contiguity cluster leader node ALN(or CLN)301 and course metric ($path\_met_{ALN}$) of 302and cluster metric is normalized by the number of nodes of a cluster. The cluster best for uniting gives smallest area metric using the following formula. In the 2nd following formulacourse metric to a contiguity cluster leader node is expressed with $path_met_{ALN}$and it expresses course metric to the other node with $path\_met_i$.
[0070]
[Equation 3]

For examplethe node 303 may be unable to find the cluster leader node (221-233) which can admit to participate and be related like a network start. In this casethe node 211 may decide to fightsince it becomes a cluster leader node. When it is decided that it fights since the ordinary node 303 turns into a cluster leader nodethe node 303 starts the following procedure. In order to announce the value

for becoming a cluster leader nodethe node 303 carries out multiple address transmission of the special CLNANN message of a type to all the nodes 211 in the hop area of eye k_N watch. The value for becoming a cluster leader contains cluster leader metric calculated by the node concerned which announced this value. About aiming at reliabilityeach of the node 211 of the area of eye k_N watch sends a reply to a CLNANN message preferably. To the node which does not perform this replya follow-up CLNANN message may be transmitted by the unicast so that I may be understood by the person skilled in the art.

[0071]

The node 211 replied in the affirmative to a CLNANN message replies a CLNANN message which shows that it recognizes that the node 303 turns into a cluster leader node. The node 211 to a reason for there being nothing in a position for the node 211 concerned to turn into a cluster leader node. Or the node 211 concerned carries out this affirmative reply to a reason for having larger cluster leader metric than cluster leader metric [which was received by an original CLNANN message]. The node 211 which sends a reply in the negative to a CLNANN messageA CLNANN message which the node 211 concerned has cluster leader metric better than cluster leader metric [which was received by an original CLNANN message]and announces what the node 211 concerned will be a better cluster leader is replied. Though a cluster leader will interchange when a cluster leader metric value is the samea cluster leader's role is given to a node with for example lowest node ID.

[0072]

When all the CLNANN messages are affirmativeor when [although there was competition] the node 303 obtains a cluster leader's rolethe node 303 concerned takes over a cluster leader's role. This node 303 starts periodic multiple address transmission of a regular CLNANN message which should be transmitted about n_{CL} hopand the CLNANN message concerned reaches all the nodes of the contiguity cluster 212and contiguity cluster leader nodes by this. Other nodes 211 may begin to consider whether it should participate in this new cluster. Howeverwhen not the node 303 but another node obtains a role of a cluster leader nodethe node 303 considers whether it should participate in this new cluster leader's cluster.

[0073]

According to this inventionspecification of a cluster leader node may be beneficially performed using QoS metric total which multiplied by a weighting factor. If drawing 12 is referred to especiallyit will be started with the block 90and a mode of this method of this invention will carry out the group division of two or more nodes 211 at a clusteras mentioned aboveand will determine QoS node metric about each node of each cluster with the block 92. Hereeach QoS node metric corresponds to a QoS node parameter.

[0074]

A QoS node parameter is ranked in order of importance (block 93). One example of this rank is given by an item "CLN node selection" of a column of Table 1. Howeverother suitable ranks and/or QoS parameters may be used in other

embodiments. As mentioned abovein the block 94a weighting factor takes the advantage of QoS node metric each based on a QoS node parameter. Total of a QoS node parameter which multiplied by a weighting factor may be generated. In the block 95QoS node metric (or QoS node metric total which multiplied by a weighting factor) which multiplied by a weighting factor about each node of a predetermined cluster receives mutuallyand is comparedand a method is completed (block 96). QoS node metric may be the same as what was mentioned above. Specification of a cluster leader node and further details of node union and intervention are explained to U.S. patent application 10th / No. 134559.

[0075]

It will be understood by person skilled in the art that this invention provides a mechanism which expresses and uses node metric and link metric which are used in various application over which it goes by a network self-organizing from selection of a QoS route various typeand which were generalized. Although approach mentioned above was explained about using total of QoS which multiplied by a weighting factorin addition to totalingit will be understood that suitable data for comparison may be provided using other suitable mathematical operations. According to some above-mentioned embodimentsalthough QoS node metric or QoS link metric were explainedin various embodimentsthese things [that both may be used while it is metric] will be understood.

[Brief Description of the Drawings]

[Drawing 1]It is a schematic diagram of the move ad hoc network containing the QoS route according to this invention.

[Drawing 2]It is a schematic diagram of the move ad hoc network containing the QoS route according to this invention.

[Drawing 3]It is a schematic diagram of the move ad hoc network containing the QoS route according to this invention.

[Drawing 4]It is a schematic diagram of the move ad hoc network containing the QoS route according to this invention.

[Drawing 5]It is a flow chart explaining the stage of the method for the QoS route in the move ad hoc network according to this invention.

[Drawing 6]It is a flow chart explaining the mode of the method of choosing a route based on the QoS metric weighted average according to this invention.

[Drawing 7]It is a flow chart explaining the mode of the method of this invention which chooses the contiguity cluster target node based on the QoS metric weighted average according to this invention.

[Drawing 8]It is a schematic diagram of the ad hoc network by this invention.

[Drawing 9]It is a schematic diagram of the ad hoc network of drawing 8 in which the selected route between a source node and a destination node is shown.

[Drawing 10]It is a schematic diagram explaining a group division of the cluster according to this inventionand cluster leader node designation.

[Drawing 11]It is a flow chart explaining the mode of the method of this invention which relates a node with each cluster based on the QoS metric weighted average according to this invention.

[Drawing 12]It is a flow chart explaining the mode of the method of this invention which chooses a cluster leader node based on the QoS metric weighted average according to this invention.

[Description of Notations]

1 Source node
23and 5 Intermediate node
4 Destination node
20 Move ad hoc network
30 Moving node
214 Source node
215 Destination node
211 Node
212 Cluster
213 Wireless communications link
221 A cluster leader nodea cluster
217a Contiguity cluster target node

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

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213 Wireless communications link

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